

WHAT IS CLAIMED IS:

1. A finger operating in symbol-rate, comprising:

descrambling means that descrambles base-band received signal using frame time information by multiplying base-band digital signal by PN-code;

pilot integrating means that produces pilot signal by integrating descrambled signal from said descrambling means;

weight vector computing means that produces weight vector using signals from said descrambling means and said pilot integrating means;

pilot weighting means for producing phase compensating signal to compensate phase delay of channel by multiplying the weight vector from said weight vector computing means with the pilot signal;

Walsh despreading means for providing received data for each of traffic channels, by integrating multiplied signals each of the channels for corresponding code length time, after multiplying outputs of said descrambling means and corresponding Walsh codes;

traffic channels weighting means in symbol-rate for weighting each traffic channel signal from the Walsh despreading means by using the weight vector; and

channel compensation means for compensating phase distortion caused by phase delay to each output of said Walsh despreading means by using output of said pilot weighting means and traffic channels weighting means.

2. The finger according to claim 1, further comprises tracking means for producing a frame tracking information for compensating small changes in path delay.

3. The finger according to claim 2, wherein said tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of early and late descrambling wherein a first and a second synch time information are used, respectively.

4. The finger according to claim 2, wherein said tracking means produces the frame tracking information from difference between two energies which are obtained by squaring weighted sums of integrations of descrambled signals provided through early and late descrambling wherein a first and a second synch time information are used, respectively.

5. The finger according to claim 2, wherein said tracking means produces the frame tracking information from difference between two energies which are obtained by squaring results of integrations of weighted sums between the weight vector and descrambled signals provided through said early and late descrambling wherein a first and a second synch time information are used, respectively.

6. The finger according to claim 3, wherein said tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of said early and late descrambling wherein the first and the second synch time information are used, respectively, such the frame tracking information is produced after filtering said difference between said two energies.

7. The finger according to claim 4, wherein said tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of said early and late descrambling wherein the first and the second synch time information are used, respectively, such the frame tracking information is produced after filtering said difference between said two energies.

8. The finger according to claim 5, wherein said tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of said early and late descrambling wherein the first and the second synch time information are used, respectively, such the frame tracking information is produced after filtering said difference between said two energies.

9. The finger according to claim 3, wherein the first synch time information for said early descrambling is earlier than the frame timing information by about 0.2 to 0.5 chip duration while the second synch time information for said late descrambling is later than the frame timing information by about 0.2 to 0.5 chip duration.

10. The finger according to claim 4, wherein the first synch time information for said early descrambling is earlier than the frame timing information by about 0.2 to 0.5 chip duration while the second synch time information for said late descrambling is later than the frame timing information by about 0.2 to 0.5 chip duration.

11. The finger according to claim 5, wherein the first synch time information for said

early descrambling is earlier than the frame timing information by about 0.2 to 0.5 chip duration while the second synch time information for said late descrambling is later than the frame timing information by about 0.2 to 0.5 chip duration.

12. The finger according to claim 1, wherein said descrambling means multiplies the received signal in digital state(I<sub>rx</sub>, Q<sub>rx</sub>) with a local PN-code using a finger timing information (f<sub>timing</sub>) provided from outside finger.

13. The finger according to claim 1, wherein said pilot integrating means retrieves the pilot signal to be used as input of weight vector computing means by integrating output (y vector signal) of said descrambling means for preset period of time.

14. The finger according to claim 13, wherein said weight vector computing means produces the weight vector (Weight<sub>I</sub>, Weight<sub>Q</sub>) using the x\_vector signal and the y\_vector signal.

15. The finger according to claim 14, wherein said weight vector computing means is reset to initial state upon reception of frame reset signal (f<sub>reset</sub>) which is generated by finger death signal (f<sub>death</sub>) when the PN-code acquisition is lost such that PN-code acquisition for lost path can be restarted with initial state.

16. The finger according to claim 13, wherein said pilot weighting means calculates phase delay associated with desired signal at each antenna element by using the weight

vector from said weight vector computing means to compensate phase delay of each traffic channel.

17. The finger according to claim 1, wherein said Walsh despreading means includes:

FCH (fundamental channel) despreading means for retrieving data transmitted through FCH (fundamental channel) by multiplying result of said descrambling of an array output with the Walsh code corresponding to the FCH;

DCCH (dedicated control channel) despreading means for retrieving data transmitted through DCCH (dedicated control channel) by multiplying result of said descrambling of the array output with the Walsh code corresponding to the DCCH;

SCH 1 (Supplemental channel 1) despreading means for retrieving data transmitted through SCH 1 by multiplying result of said descrambling of the array output with the Walsh code corresponding to the SCH 1; and

SCH 2 (Supplemental channel 2) despreading means for retrieving data transmitted through SCH 2 by multiplying result of said descrambling of the array output with the Walsh code corresponding to the SCH 2.

18. The finger according to claim 17, wherein said traffic channels weighting means comprises:

FCH weighting part for compensating phase from reference antenna by weighting the FCH in symbol-rate;

DCCH weighting part for compensating phase from reference antenna by weighting

the DCCH in symbol-rate;

SCH 1 weighting part for compensating phase from reference antenna by weighting the SCH 1 in symbol-rate; and

SCH 2 weighting part for compensating phase from reference antenna by weighting the SCH 2 in symbol-rate.

19. The finger according to claim 18, wherein said channel compensating means is located for compensating said phase distortion due to path delay associated with each of traffic channels the FCH, the DCCH, the SCH 1, and the SCH 2.

20. The finger according to claim 19, wherein said tracking means includes:

first complex descrambling means for multiplying the received signal with the PN-code of 1/2 chip advanced time to the  $f_{\text{timing}}$ ;

second complex descrambling means for multiplying the received signal with the PN-code of 1/2 chip retarded time to the  $f_{\text{timing}}$ ;

first and second energy estimation means for providing correlation energies by integrating results of said early descrambler and late descrambler, respectively; and

tracking information ( $f_{\text{trk}}$ ) generating means for providing the tracking information ( $f_{\text{trk}}$ ) by comparing magnitudes of results of said first and second energy estimation means.

21. A demodulation apparatus that uses fingers operating in symbol-rate for mobile communication system comprising:

analog-to-digital converter (ADC) for converting analog signal, which has been frequency-down converted to base-band, to corresponding digital signal through oversampling procedure;

searcher for transmitting a searcher-energy that exceeds preset threshold value to lock detector while the searcher-energy is computed through correlation procedure between outputs of said ADC and a PN-code corresponding to pilot channel;

lock detector for generating signals needed for accurate frame synchronization including frame reset information ( $f_{\text{reset}}$ ), frame timing information ( $f_{\text{timing}}$ ), frame death information ( $f_{\text{death}}$ ) using said correlation energy provided from said searcher; and

at least one finger for weighting in symbol-rate traffic channel signals with weights which are obtained from the received data in the pilot channel of the reverse link.

22. The demodulation apparatus according to claim 21, wherein said finger comprises:

descrambling means that descrambles base-band received signal using frame time information by multiplying base-band digital signal by the PN-code;

pilot integrating means that produces pilot signal by integrating descrambled signal from said descrambling means;

weight vector computing means that produces weight vector using signals from said descrambling means and said pilot integrating means;

pilot weighting means for producing phase compensating signal to compensate phase delay of channel by multiplying the weight vector from said weight vector computing means with the pilot signal;

Walsh despreading means for providing received data for each of traffic channels, by integrating multiplied signals each of the channels for corresponding code length time, after multiplying outputs of said descrambling means and corresponding Walsh codes;

traffic channels weighting means in symbol-rate for weighting each traffic channel signal from the Walsh despreading means by using the weight vector; and

channel compensation means for compensating phase distortion caused by phase delay to each output of said Walsh despreading means by using output of said pilot weighting means and traffic channels weighting means.

23. The demodulation apparatus according to claim 22, wherein said finger further comprises tracking means for producing the frame tracking information from difference between two energies which are obtained by integrating results of said early and late descrambling wherein said first and second synch time information are used, respectively, in order to produce the frame tracking information for compensating small changes in path delay

24. The demodulation apparatus according to claim 21, wherein said searcher comprises:

received signal processing means for achieving envelope detection of the received data such that the correlation energy to be obtained at each antenna channel;

adding means for summing up the correlation energies at each of antenna channels obtained from said received signal processing means; and

output means for generating result of said adding means as final output of non-



coherent detection.

25. The demodulation apparatus according to claim 24, wherein said received signal processing means comprises:

first arithmetic means for computing magnitude of said correlation energy at each antenna channel by adding results of square of processing results along I-channel and Q-channel; and

second arithmetic means for summing up results of computed magnitude of said correlation energy at each of antenna channels.

26. A demodulation method using fingers that operates in symbol-rate for mobile communication system, comprising:

a first step of descrambling received signal by multiplying a PN-code with a received signal using frame timing information ( $f_{\text{timing}}$ );

a second step of generating a pilot signal obtained by integrating a descrambled signal in order to use it for computing weights;

a third step of computing a weight vector using the descrambled signal and the pilot signal;

a fourth step of generating a phase compensating signal to compensate phase delay of channel by multiplying the weight vector with the pilot signal;

a fifth step of providing received data for each of traffic channels, by integrating multiplied signals each of the channels for corresponding code length time, after multiplying the descrambled signal and corresponding Walsh codes;

a sixth step of weighting each traffic channel signal by using the weight vector of each channel in symbol-rate; and

a seventh step of compensating phase distortion due to channel delay by using a phase compensating signal to weighted traffic signal.

27. The demodulation method according to claim 26, wherein said fourth step, the weight vector is multiplied by said pilot signal after said pilot signal is exactly calculated through phase delay estimation.

28. A computer-readable recording medium for recording a program that embodies the method using fingers operating in symbol-rate comprising:

a first function of descrambling received signal by multiplying a PN-code with a received signal using frame timing information ( $f_{\text{timing}}$ );

a second function of generating a pilot signal obtained by integrating a descrambled signal in order to use it for computing weights;

a third function of computing a weight vector using the descrambled signal and the pilot signal;

a fourth function of generating a phase compensating signal to compensate phase delay of channel by multiplying the weight vector with the pilot signal;

a fifth function of providing received data for each of traffic channels, by integrating multiplied signals each of the channels for corresponding code length time, after multiplying the descrambled signal and corresponding Walsh codes;

a sixth function of weighting each traffic channel signal by using the weight vector of

each channel in symbol-rate; and

a seventh function of compensating phase distortion due to channel delay by using a phase compensating signal to weighted traffic signal.